

Granulation (making of granules)

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Granulation is the act or process of forming or crystallizing into grains.^[1] Granules typically have a size range between 0.2 to 4.0 mm depending on their subsequent use.

Synonym "Agglomeration": Agglomeration processes or in a more general term **particle size enlargement** technologies are great tools to modify product properties. Agglomeration of powders is widely used to improve physical properties like: wettability, flowability, bulk density and product appearance.

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Chemical industry

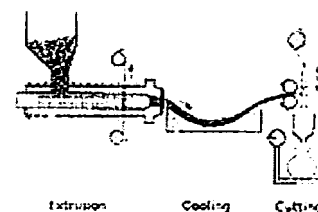
In the chemical industry, granulation refers to the act or process in which large objects are cut or shredded and remelted into granules or pellets.

Pharmaceutical industry

In the pharmaceutical industry, granulation refers to the act or process in which primary powder particles are made to adhere to form larger, multiparticle entities called granules. It is the process of collecting particles together by creating bonds between them. Bonds are formed by compression or by using a binding agent. Granulation is extensively used in for the manufacturing of tablets, pellets (or spheroids).

The granulation process combines one or more powders and forms a granule that will allow tableting or spheronization process to be within required limits. This way predictable and repeatable process is possible and quality tablets or pellets can be produced using tableting or spheronization equipment.

Why Granulation



Granulation

Granulation is carried out for various reasons, one of those is to prevent the segregation of the constituents of powder mix. Segregation is due to differences in the size or density of the component of the mix. Normally, the smaller and/or denser particles tend to concentrate at the base of the container with the larger and/or less dense ones on the top. An ideal granulation will contain all the constituents of the mix in the correct proportion in each granule and segregation of granules will not occur.

Many powders, because of their small size, irregular shape or surface characteristics, are cohesive and do not flow well. Granules produced from such a cohesive system will be larger and more isodiametric, both factors contributing to improved flow properties.

Some powders are difficult to compact even if a readily compactable adhesive is included in the mix, but granules of the same powders are often more easily compacted. This is associated with the distribution of the adhesive within the granule and is a function of the method employed to produce the granule.

For example, if one were to make tablets from granulated sugar versus powdered sugar, powdered sugar would be difficult to compress into a tablet and granulated sugar would be easy to compress. Powdered sugar's small particles have poor flow and compression characteristics. These small particles would have to be compressed very slowly for a long period of time to make a worthwhile tablet. Unless the powdered sugar is granulated, it could not efficiently be made into a tablet that has good tablet characteristics such as uniform content or consistent hardness.

Granulation techniques

In pharmaceutical industry, two types of granulation technologies are employed, namely, Wet Granulation and Dry Granulation.

Wet Granulation

Wet granulation, the process of adding a liquid solution to powders, is one of the most common ways to granulate. It involves the massing of a mix of dry primary powder particles using a granulating fluid. The fluid contains a solvent which must be volatile so that it can be removed by drying, and be non-toxic. Typical liquids include water, ethanol and isopropanol either alone or in combination. The liquid solution can be either aqueous based or solvent based. Aqueous solutions have the advantage of being safer to deal with than solvents.

Water mixed into the powders can form bonds between powder particles that are strong enough to lock them together. However, once the water dries, the powders may fall apart. Therefore, water may not be strong enough to create and hold a bond. In such instances, a liquid solution that includes a binder (pharmaceutical glue) is required. Povidone, which is a polyvinyl pyrrolidone (PVP), is one of the most commonly used pharmaceutical binders. PVP is dissolved in water or solvent and added to the process. When PVP and a solvent/water are mixed with powders, PVP forms a bond with the powders during the process, and the solvent/water evaporates (dries). Once the solvent/water has been dried and the powders have formed a more densely held mass, then the granulation is milled. This process results in the formation of granules.

The process can be very simple or very complex depending on the characteristics of the powders, the final objective of tablet making, and the equipment that is available. In the traditional wet granulation method the wet mass is forced through a sieve to produce wet granules which is subsequently dried.

Dry Granulation

The dry granulation process is used to form granules without using a liquid solution because the product to be granulated may be sensitive to moisture and heat. Forming granules without moisture requires compacting and densifying the powders. In this process the primary powder particles are aggregated under high pressure.

Dry granulation can be conducted under two processes; either a large tablet (slug) is produced in a heavy duty tableting press or the powder is squeezed between two rollers to produce a sheet of materials (roller compactor, commonly referred to as a chilsonator).

When a tablet press is used for dry granulation, the powders may not possess enough natural flow to feed the product uniformly into the die cavity, resulting in varying degrees of densification. The roller compactor uses an auger-feed system that will consistently deliver powder uniformly between two pressure rollers. The powders are compacted into a ribbon or small pellets between these rollers and milled through a low-shear mill. When the product is compacted properly, then it can be passed through a mill and final blend before tablet compression.

See also

- Granular material
- Pelletizing
- Spheronisation

References

1. ^ Granulation definition (<http://www.thefreedictionary.com/granulation>)
- Pharmaceutics - The science of dosage form design - M. E. Aulton 2nd EDT
 - Pharmaceutical dosage forms and drug delivery system - Loyd V. Allen, Nicholas G. Popovich & Howard C. Ansel 8th EDT

External links

- Nanoparticle technology handbook Hosokawa Corporation (http://www.elsevier.com/wps/find/bookdescription.cws_home/712430/description)
- 5th International Granulation Workshop (<http://www.sheffield.ac.uk/agglom2011>)

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Categories: Granular materials

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